



CHRISTINA WALD CREATED THIS YOUNG LADY AS SHE DEMONSTRATED TVPaint AND THE PICASSO II IN EXPERT'S BOOTH AT WOC TORONTO !

design by Paul Wehner

OHIO VALLEY AMIGA USERS' GROUP

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NEXT MEETING JAN. 25, 1994  
ROOM 502 RIEVESCHL HALL, UC  
BEGINNERS SIG AT 6:30  
TIMM MARTIN  
SCHEDULED TO SPEAK

# The Presidents Palaver

Ed Hoffmann

As we expected, 1993 was quite an eventful year for the microcomputer business and the Amiga in particular. Now it looks as if 1994 will be even more interesting. CD32 is introduced to the North American market, while taking Europe by storm (would you believe the number one CD game console with 320,000 units sold?). I heard that Commodore is shipping 40,000 A4000s a month, and the A1200s are flying off of the shelves in England. AAA chipset machines may be here by fall, AmigaDOS 3.1 will be available for all Amigas (well, maybe not the A1000) Real Soon Now, the CD32 games market is intensifying, the Screamer from NewTek is coming, networking solutions are everywhere, and the Commodore financial roller coaster just seems to roll on. Time will tell what the year holds (not very prophetic, eh?)

The new year also means a couple of other things: first, most memberships expire, so please pay your dues; and second, OVAUG officer elections are coming. At the February meeting we will accept nominations for all OVAUG officer positions, with elections in March, and installation of new officers in April. Consider now if you want to contribute to the club as a club officer, or if you want to nominate someone who you think will do a good job. Oh, and don't forget to pay your dues.

There have been a lot of developments in the Amiga market, and I thought I would mention a few of them. First, there is a new publication called The Scientific Amigan. This is a new publication devoted to addressing the needs of research, development, and design with the Amiga. This newsletter-format monthly provides the technical focus that general Amiga publications lack. A charter subscription is \$29 per year (available until Feb. 1994), normally \$39. Contact: Scientific Amigan POB 60685 Savannah, GA 31420-0685 CompuServe 72755,135 Internet waltal@well.sf.ca.usa

Also, more and more Envoy (Commodore's networking software) licenses are appearing. Village Tronic, makers of the PicassoII board, are selling a parallel port networking solution called "Liana" for DM 129 (\$75). ABF are selling their Amiga Link solution with Envoy for DM 398 (\$229). And don't forget to catch Babylon 5 (the series) to be aired on Channel 19 this month (sorry, I don't know when - check your local listings). CD32 modules for the A1200 and A4000 are coming. The A1200 version has a SIMM socket, supporting a 1-8 MB SIMM; FPU socket, Akiko chip, and external CD-ROM unit, while the A4000 version sports the MPEG stuff on a Zorro III card, as well as Akiko and the same external CD-ROM unit. It will also work on the A3000, although some games probably won't work since they require AGA.

Finally, a little humor, courtesy of Amiga Report 2.01 and Usenet. Did you ever wonder what driving to the store would be like if operating systems ran your car?

**MS-DOS:** You get in the car and try to remember where you put your keys.

**WINDOWS:** You get in the car and drive to the store very slowly because attached to the back of your car is a freight train.

**OS/2:** After fueling up with 6000 gallons of gas, you get in the car and drive to the store with a motorcycle escort and a marching band in procession. Halfway there, the car blows up, killing everybody in town.

**UNIX:** You get in the car and type GREP STORE. After reaching speeds of 200 mph en route, you arrive at the barber shop.

**Windows NT:** You get in the car and write a letter that says, "go to the store". Then you get out of the car and mail the letter to your dashboard.

**MacIntosh System 7:** You get in the car to go to the store and the car drives you to church.

**AmigaDOS 3.0:** You get in the car and it drives you to a great little store no-one else in town knows about.

**...and don't forget to renew your memberships!**

## CLUB DISKS FOR DECEMBER

Compiled for your edification and pleasure by club Librarian Scott Bennett.  
Available for copy at \$1.50 each, plus disk, from the BBS, at the meeting,  
or at Expert.

### DEC\_93\_01

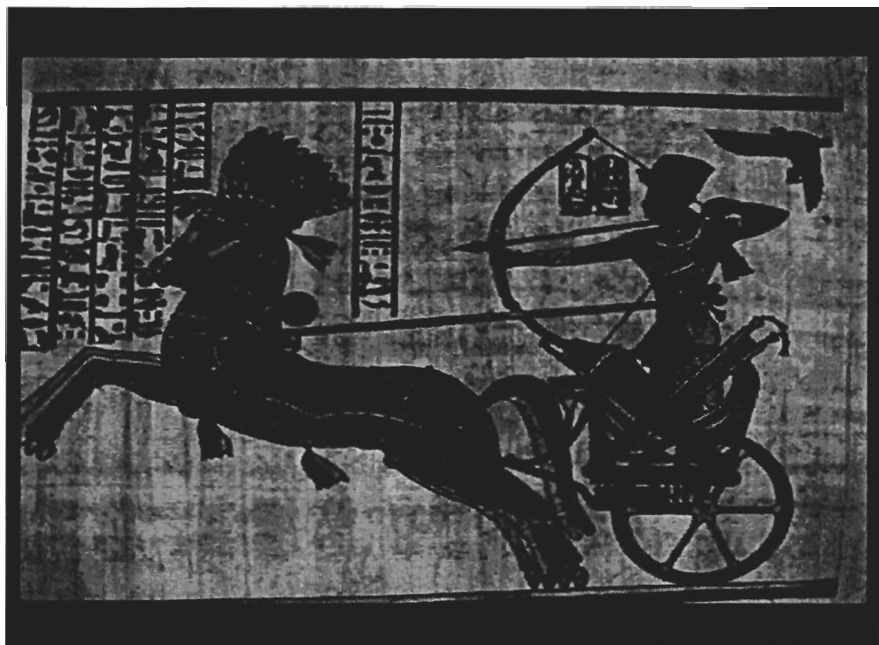
|                   |                                             |
|-------------------|---------------------------------------------|
| canonbjc.lha      | Printer driver for cannon BJC-600           |
| catalog7.lzh      | Disk cataloger                              |
| dercruncher14.lha | Intuition decompressing program             |
| disklabelsfw.lha  | Disk labeler                                |
| dt.lha            | Desktop - lets you graphically pick screens |
| FastJPEG_1.0.lha  | JPEG viewer                                 |
| FileReaderV11.lha | "speaks" txt files-remembers pronunciation  |
| adl9311.lha       | AmigaDemo list in *.guide format            |
| agalist-list2.lha | AGA software compatibility list             |
| amiflick110.lha   | Flick animation player                      |
| ar134.lha         | Amiga Report                                |
| ar135.lha         | Amiga Report                                |
| ar136.lha         | Amiga Report                                |
| ar137.lha         | Amiga Report                                |
| BigAnim36.lha     | Direct from HD anim player v36              |
| boot.lha          | Lets you select different startups          |
| buildanim20.lha   | Animation builder                           |
| Bview_102.lha     | Picture viewer                              |

### DEC\_93\_02

|                     |                                                          |
|---------------------|----------------------------------------------------------|
| pbill22.lha         | PhoneBill2.2-comm logfile analyzer-TERM,JRCOMM,Terminus  |
| rend105.lha         | Rend24 conversion/animation program                      |
| setpatch37.lha      | Setpatch for Workbench 2.0 -> 2.05                       |
| setpatch40.lha      | Setpatch for Workbench 2.1 and higher                    |
| DISTCALL.LHA        | A great piano MOD; nicely done.                          |
| KingCON.lha         | New console handler-many nice features                   |
| magicmenu_v1.29.lha | Magic menu                                               |
| megaball.lha        | Arkanoid (fancy breakout) style game, multitasks, GREAT! |

### DEC\_93\_03

|                 |                              |
|-----------------|------------------------------|
| vzii100.lha     | VirusZ v1.00; latest to date |
| snake1.jpg      | JPG Pic                      |
| q-blue1.0.lha   | Q-Blue QWK reader            |
| scripti2.lha    | Scripts for AdPro            |
| SS-Starwars.lha | A different type of 3d pic   |
| SS-Trumpet.lha  | A different type of 3d pic   |
| vektor.lha      | Light cycles type game       |



**PHARAOH on a CHARIOT**

**WRAPPED ONTO TWO DIFFERENTLY SHAPED LIGHTWAVE OBJECTS**





# DAN DYKE DIGS

**TUT and WIFE - original artwork**



**ABOVE: STRETCH WRAP  
BELOW: PLAIN WRAP**



Our club's resident archaeologist and Biblical scholar, Dan Dyke, has been using Lightwave for a most unusual purpose. As published here once before, Dan digitizes archaeological images and wraps them onto objects he creates in Lightwave. This image is Tut and Wife wrapped onto a cup in two manners. Above the image is wrapped and stretched resulting in a realistic looking artifact. Below the image is not stretched showing detail more accurately.

# THE FUTURE OF THE AMIGA

Jeff Johnson

Pretentious? ... well, I have just been watching Rush, and yes, it rubs off. Then, I hear he has nightmares about his gasbag rupturing.

".....besides, the naysayers are so uninteresting, for the most part. They have nothing to say, except nay." --Armistead Maupin

I was reading a piece in a current Mac magazine concerning the author's angst as to why the Mac hasn't conquered the World. It was similar to we Amigans' thinking. He had a list of "What If's...". They concerned pricing, configurations, bundling, compatibility, software cornucopia, etc.

Of course, the Amiga's pricing has always generally been in line. Compatibility? Well we've had bridgeboards for years, and Apple is just now making, guess what, a 'clone board!! The Amiga can emulate a Mac right well. So just why is the "Intel Inside" brigade on the march?

The reason for the success of the 'clones is that most everybody makes them, they have always been an open platform. With so many companies competing, they should be all over the place. Now-a-days most folks buy IBM compatibles because they really are all over the place. Another reason mentioned often is that software can be brought home from work. The author suspects that it must be a pleasure to face DIP switches. IRQ's, and messy DOS because success is so hard won.

Other arguments aside, Macs and Amigas aren't generic, they are proprietary. In terms of mass marketing, that kills just about anything, ultimately. Example?? Why did VHS beat out Beta? I still use my Beta machines everyday as three hour superBeta looks and copies better than two hour VHS. But VHS is now everywhere. The reason is that JVC licensed VHS more liberally and marketed it better. The general public (mindless idiots that we are) will buy anything that is all over the shelves where they shop, so long as it is at least adequate.

No amount of advertising could have ascertained the Amiga's success. It has succeeded (yes it has) as a "niche" product due to the efforts of us Amigoids and NTSC.

Now, "niche" seems to be a dirty word, an embarrassment. Not any more. Not in a mature market. Everything is a niche. Think of road vehicles. Light trucks out-sell passenger cars. The full size sedan is itself a niche. When a technology becomes mature, specialization is the norm. What is a general purpose computer these days?? What is the proposed purpose? Most machines are configured for

a certain function, therefore they occupy a niche.

In my view, the Mac is the most threatened platform. What does it have to offer? An elegant operating system? It's single tasking! Distinctive software? Most has migrated to 'clones, too. This isn't Mac bashing at all, but a consideration of why use what. Certainly the Mac will be used and respected for a long time yet, but consider the scene in 1984. The Commodore 64 was a hot item then. Do we miss ours now, just ten years later? With fond memories yes, but do we use them?

Ultimately, these computers of ours are toys and tools. When they fail to bring utility or pleasure we "upgrade". An Amiga's glaring deficiency in the office environment, besides a lack of standard software, has been the interlaced display. Even if "Lotus" was ported, how would 200 line or flickering displays look anyhow? That "TV" video, however, is really the Amiga's salvation. NTSC video is something we have, with the Toaster environment, that makes us special. We have carved a niche. Our operating system can stand tall with any of them, even the other modern OS's.

Hardware is becoming so powerful anymore that it won't be all that important in years hence. The versatile OS's and speedy hardware of the future will simply sense which OS the application software was meant to be run under, create a virtual machine for that software, and get on with it. The likes of Mac Photoshop, Amiga Pagemaker, and QuattroPro will all multitask on one little chip with a power supply deriving energy from the heat off your fingertips on the keyboard (if there still is a keyboard).

What I'm saying is that we needn't worry about the future of our Amigas. They will be functional and supported as long as they are useful. By the time they aren't, we won't care. Whether the new equipment is a successor to the Amiga or not, what we will have upgraded to will render what we use now just a quaint, fond memory.

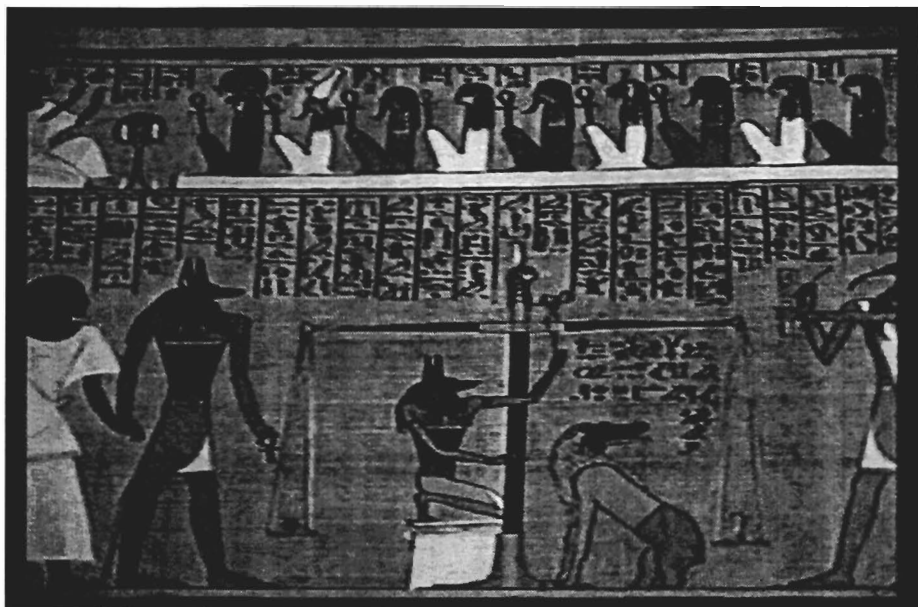
Club member Jim Sutter reports that he has contacted Timm Martin, the author of SID!

Timm has agreed to speak to OVAUG at our January 25th meeting!!

**PAY YOUR DUES AND MEET A LEGEND!!!**



# WEIGHING THE HEART



AN EGYPTIAN PAPYRUS SCANNED BY DAN DYKE

AND NOW, IN THIS CENTURY,  
**IT'S OVAUG MEMBERSHIP RENEWAL  
TIME!**

BENEFITS OF MEMBERSHIP INCLUDE -

SUPPORT OF A VAST CAST OF FELLOW AMIGIODS  
AN UNSURPASSED POOL OF KNOWLEDGE  
ASSOCIATION WITH ARTIES AND GEARHEADS  
DISCOUNT AT EXPERT SERVICES  
MONTHLY NEWSLETTER  
YUCKFEST AKA MONTHLY CLUB MEETING

ALL FOR \$15.00 SINGLE OR \$20.00 FAMILY  
PLEASE REMIT TO:

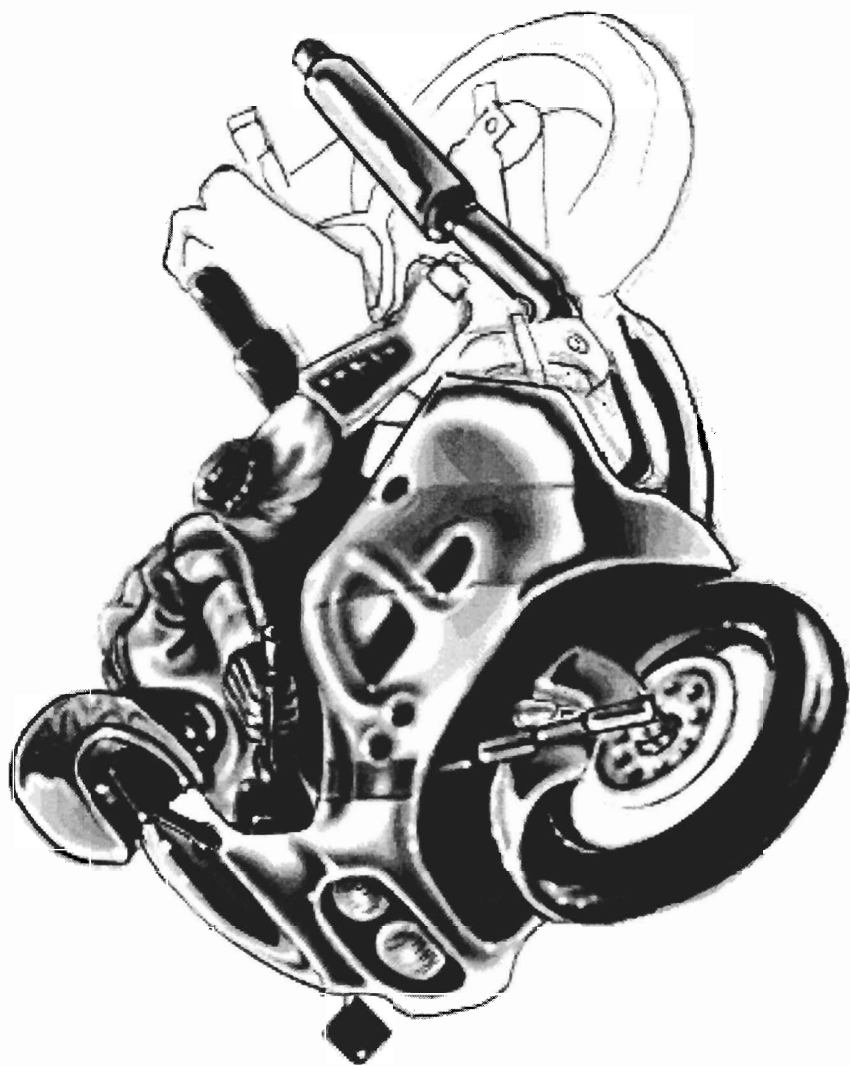
OVAUG, POB 428539  
CINCINNATI, OH 45242-8539

-OR-

GEORGE GIBEAU  
AT MEETING OR EXPERT SERVICES

**OVAUG JANUARY p. 7**





**Christina Wald created this wild ride while demonstrating the use of TVPaint on the Picasso II display board. She exercised her talents in the Expert Services booth at the recent Toronto World of Commodore show.**

# The Evolution of SCSI

Jan Dedek, Ancot Corp.

(This article was originally published in the Electronic Design News Product Edition, December 13, 1993, and is reprinted here with permission of the publisher. The author is president of Ancot Corporation, a designer and manufacturer of SCSI test equipment and bus switches for the SCSI interface, primarily for developers and integrators. An informative book, "Basics of SCSI", by the same author is a popular tutorial on the SCSI interface. A single copy is available free for the asking by calling Ancot at 415-322-5322. - Ed Hoffmann)

Computer technology is developing faster and faster. As the old saying goes "the more you have, the more you want", so a similar situation is developing with computer applications. The available performance is never high enough. Systems which were considered "high performance" some 15 years ago are now considered museum pieces.

Before beginning our discussion of computer performance, let's first review the primary parts of a computer system. The classical division consists of three main components. They are:

- the processor (with its arithmetic unit)
- the memory (main memory with cache)
- the input/output (including peripherals).

During the last few years, we've seen dramatic improvements in processor performance (RISC architecture, parallel processing, etc.). Similar improvements also occurred in memories; using a cache is now common, even in small systems. In addition to this, today we can find the processor and memory in the same chip, or at least on the same PCB. As a result of all of this development, suddenly we find that the input/output interface stands out as the weakest part of a computer system.

The speed and performance of peripherals are often limited by mechanical properties, making it difficult to increase them significantly. In other words, we cannot speed up the peripherals as the architecture would wish. Often, we have to compromise and use a buffer, trying to mask this new "Achilles heel" called the peripheral bus.

## What is a Peripheral Bus?

The main characteristics of a peripheral bus are: use of a cable over distances of up to several meters, a serial/parallel connection, and frequently the universal utilization of interconnect lines. Do not confuse the peripheral bus, sometimes called an "intelligent bus" with a backplane bus.

A backplane bus uses a rigid (non-flexible) printed circuit board (PCB), typically of small dimensions (half a meter to one meter maximum), parallel connection, and the dedicated utilization of interconnect lines.

## Evolution of Peripheral Busses

Only ten years ago, most peripheral busses were custom designed for each type of peripheral. There were two main reasons for customization: one was optimization of use or performance; the second was the tendency of companies to lock-

in their OEM customers. This attitude soon became outdated and the use of standards became one of the main criteria when specifying components and selecting computer systems.

## **SASI**

Shugart Associates in California was among the first companies to come out with an idea for a universal peripheral bus in 1980; it was called "SASI" (Shugart Associates Standard Interface). Soon, several other companies joined in, and under the guidance of ANSI (American National Standards Institute) they developed an improved version and named it "SCSI" (Small Computer System Interface). The SCSI standard was approved in 1986 (ANSIX3.131-1986).

The main advantage of SCSI is its simplicity - we need only a single (SCSI) adapter in order to connect a mix of peripherals (having various functions and speeds) on the same cable which, in turn, is connected to the I/O connector (on the adapter). We need only to add a new I/O driver for each new device type. Hardware and software are drastically simplified, and the development cycle is shortened, sometimes in half, sometimes by a factor of ten.

When the first standard was approved, it was named SCSI, but later it became known as SCSI-1 to distinguish it from future versions. Remember, therefore, that SCSI and SCSI-1 refer to the same standard.

The introduction of SCSI was considered revolutionary in the early eighties, but by today's standards its performance characteristics would be considered limited. Fortunately, typical SCSI-1 implementations of that period were also limited and did not utilize all the functionality offered by the new standard.

## **SCSI-1**

In the early eighties, microcomputers were really limited and, therefore, only magnetic disks were considered by SCSI. The SCSI bus originally used only two devices: the host bus adapter (SCSI Initiator) and the disk itself (SCSI Target). Arbitration was not needed/used, since there were no other devices to consider. The computer hardware was much smaller and the disk was built into the main enclosure together with the processor using a short cable. Parity protection was also not needed because there were no electromagnetic (EM) radiation problems.

### **Main Characteristics of a Typical SCSI-1 System**

- short bus with only 2 SCSI connectors
- single initiator and single target
- transfer rates of 1 MByte/sec or less
- asynchronous mode only
- no arbitration, no parity, no disconnect
- single-ended interface
- 6 byte CDBs
- very high overhead (up to 90%+)

From today's standpoint SCSI-1 may appear to be low performance. It is important to remember, however, that it was competing against the ST506 interface, typically running at 300 KByte/sec or slower. SCSI represented a significant improvement at that time.

The main problem with SCSI-1 became obvious very early; the standard

was too permissive and allowed too many "vendor specific" options [Note: this is rarely the case with the Amiga peripherals, however - Ed]. Implementations varied and there was a serious compatibility problem between products from different vendors. About the same time, when the SCSI standard was finally approved in 1986, the Common Command Set (CCS) was proposed as an attempt to resolve the compatibility problems. The CCS was a subset of the SCSI standard which did not allow exceptions.

## **SCSI-2**

Work on the new standard, SCSI-2, started in 1986. The original idea was to merge the CCS and SCSI-1, and "add a few improvements". As it turned out, the SCSI-2 specifications grew to more than double the size of SCSI-1. The new draft was submitted to ANSI for approval in 1990, and it was finally released in 1993 (as draft version "10L" with almost 500 pages).

SCSI-1 became a subset of SCSI-2. The transition was gradual and relatively painless, since up-compatibility was preserved. SCSI-1 is slowly disappearing, but we can still see some systems with a mix of peripherals, both SCSI-1 and SCSI-2.

### **The main improvements in SCSI-2 are:**

- transfer rate increased to 10 MHz, synchronous mode, routinely using 5 MHz
- the SCSI bus can be up to 4 bytes wide (SCSI-1 was only a single byte)
- Although the 4-byte width did not gain popularity (the cabling is so awkward, it is almost unusable), many installations today use the 2-byte wide bus achieving 20 MByte/sec burst transfer rates.
- lower overhead, often below 30%
- single-ended and different interfaces
- diversity of peripheral device types
- greatly improved compatibility
- the possibility of building more complex configurations using a mix of peripherals with differing functions and performances, all on the same SCSI cable
- improved functionality - execution of higher intelligence functions and executing them concurrently (Disconnect, Command Queuing)
- improved reliability (error reporting and classification. New commands and extended message system added)

In the early nineties, SCSI graduated to a rather powerful interface, and it is no longer restricted to use on small systems. Its main application is now actually in the arena of workstations and big systems.

## **SCSI-3**

Performance demands on computer systems are ever increasing. Computers in the early eighties had merely a single disk using perhaps 1 MByte/sec transfer rate. In the late eighties, systems used a mix of peripheral devices, most of them high performance (synchronous 4 to 10 MByte/sec is common). In the early nineties one more important requirement is being added: with the popularity of networks, designers are starting to demand a new functionality from their peripherals; the trend is toward distributed systems architecture with peripherals anywhere on the network. This is in addition to a requirement for even higher performance. Burst rates must be increased and overhead must be lowered.

For these reasons, the ANSI standards committee started working in 1991 on a new version of SCSI which would not only satisfy the requirements of today, but also allow fast and extensive growth in the future. This new standard is called SCSI-3.

### **Main Characteristics of SCSI-3**

The main characteristics of SCSI-3 will be:

- much higher performance with respect to burst transfer rates, and lower overhead
- distance will be in kilometers, rather than just meters
- expand addressability, allowing an almost unlimited number of devices on the same bus
- universality of use of the SCSI system expanded even more
- higher reliability and robustness of systems

### **How will SCSI-3 achieve these characteristics?**

- it will use serial interconnect, besides the standard parallel interconnect. Actually the serial interface will be the high performance version, which will be used almost exclusively, but the parallel version may allow backward compatibility with the large SCSI-2 installed base.
- media used can be fibre, copper coax, twisted pair, or wireless, in addition to SCSI-2/3 parallel
- packetized protocol with very low overhead
- transfer rates will not be limited by the protocol, and will be able to utilize faster media as soon as they become available.
- the protocol does not change with distance, and there is no strictly defined timeout
- more efficient and reliable new communication protocol

The SCSI command repertoire will remain, but it will be improved and extended. We can expect that SCSI-3 hardware will be different, but software will require only small changes. The main investment in software will be carried forward.

Currently, there are four proposals being considered for SCSI-3, and they may all be accepted. This is because SCSI is becoming universal, and is trying to serve diverse interests. For example there are conflicting demands on computer systems from applications like data processing and multimedia. Data processing requires error-free data delivery, as opposed to multimedia, which requires delivery of data on time, the error-free requirement being secondary.

Will backward compatibility be available? So far only one of the new proposals - the Generic Packetized Protocol (GPP) will allow both hardware (on parallel bus) and software backward compatibility with SCSI-2.

Will SCSI-2 be replaced by SCSI-3, or made obsolete altogether? It appears now that SCSI-3 will have its own market, which will be mainly in high performance workstations and other bigger and more expensive computer configurations. Serial SCSI-3 will probably first be used for mainframe-to-mainframe interfaces; or disk array to system; or for shared remote peripherals like scanners, laser printers, etc. Consequently, there is a good chance that the SCSI-2 will keep its current market for some time without any radical changes. In any case, we do not expect that SCSI-3 will replace the SCSI-2 market, as happened between SCSI-2 and SCSI-1 not so long ago.

## **NEO-KNOWLEDGE ABOUT COMPUTERS**

(FOR SMART PEOPLE WHO KNOW ABOUT JUST ABOUT EVERYTHING ELSE)

**JEFF JOHNSON**

No, we won't start with bits and bytes or whether your Intel is in or out.

If a computer is in your life now, like it or not, this is a discussion of computer fundamentals from a new user's standpoint. Imagine describing a car to someone who has only seen one from a distance, has never ridden in one, has only a vague idea what one is for, but now must learn to drive.

...so what is this thing then??

Computers are just tools, some will use their tools as toys, but they are tools none-the-less. Imagine a device which is a combination typewriter and adding machine that can show pictures and play sound. It can do certain things automatically, but it cannot do anything that you haven't told it to do. No, it doesn't know you're afraid of it.

The purpose of a computer is the processing and storage of information. That information can be words, pictures, numbers, music, anything our minds can grasp.

Let's discuss storage first. Assume that the information, is converted into a form that the computer can understand and deal with, a type of numbers called binary. Where is the information put? On a "floppy disk" that is stuck into the front of the computer. Or on a "hard drive" inside the computer. Or in "memory" inside the computer. Or over a "LAN" or "network" cable to similar places in another computer.

A "floppy disk" uses a limp piece of magnetic material like tape except that it revolves inside its case like a phonograph record. It is recorded to and played from just like tape, except in circles.

A "hard drive" is inside a case inside the computer. It is usually not removable. Inside this case are spinning disks of magnetic material just like a floppy, except that they are stiff. Hard drive size is measured in how many million "MEGS" of binary digits (computer bits) it can store.

"Memory" consists of computer chips that can remember the numbers they've been told to store. "RAM" is the most common type, and forgets if the computer is turned off or restarted (booted). RAM is what is referred to when so many "MEGS" of memory is specified. Memory MEGS are millions of bytes (8 computer bits - binary digits. There I've said it). Faster horses, younger women, and more memory. Memory IS NOT on your hard drive or floppys!! Yes, information is stored there, but they are not referred to as memory. Memory is in computer chips. Information can be copied from a floppy or hard drive to RAM, and then it is in memory.

Now let's discuss processing this information. What does the work?? Obviously the computer, but what is special about a computer that sets it apart from other equipment? An electronic adding machine can do only that, and an electronic typewriter can do only that. An electronic musical keyboard will do that but not the others. A computer can do any of it. It is this versatility that defines a computer.

The physical hardware does the work, but what makes it run? There is the "operating system" and the "application programs". This is the "software". It is called software because it consists of electrical information that tells the hardware what to do.

First, consider the "operating system", or "OS" or "DOS" (disk operating system, an out-of-date acronym but widely used to mean OS). The OS is commonly tied to certain hardware. MS-DOS to IBM compatibles, AmigaDOS to Amigas, and MacOS to Macs.

To do certain work an "application program" (APP) must be used. These are the familiar programs such as Word Perfect or Professional Page. Most computer training is actually in the use of these APPs. Few computer users need concern themselves with the operating system, other than that it will run the desired software. Let's say you type in a letter using Word Perfect. When you are finished you "save" it. Where was it put, and what is it really? Now we come to the concept of "datafiles". In computer terminology, a file is quite the same thing as a file in a folder in your office. It is in the form of the binary numbers the computer understands, but it is all in one place and has a name you've given it, the "filename". If it was put in memory or RAM it will disappear when the computer is turned off or restarted. Saving the file to the hard drive or a floppy will save it permanently until it is deleted purposely.

There are different kinds of files. They are all just collections of binary numbers but serve different purposes. One type is "user data", the letter you just typed in Word Perfect, or the picture you just drew in Deluxe Paint. Another type is a "program file" that is run (executed) by the operating system to become the program you use like Word Perfect or Deluxe Paint. Yet another is a "utility" that makes things easier or does something special. The final type are those files which comprise the operating system itself.

The files are stored in "directories" on the "device" chosen. The devices can be the floppy, hard drive, network, or memory. Let's use an analogy, a logical one being an office. Let's consider each file to be a piece of paper. They could be all left out on the floor. This is the same as the "root" directory of the device. All of the files are right in front of you, but it is a mess. Consider then a row of file cabinets. First specify which file cabinet a particular file is in. Then consider which drawer, and then which folder it is in. This nesting of storage locations makes for organization. In computer usage the file is stored within subdirectories which are in directories. The list of this organization is called the file's "path".

The different kinds of files should be stored in logical relationships. Since all types of files can be stored anywhere, keep 'em where you can find 'em.

To review:

- \* Memory is temporary storage in chips inside the computer.
- \* Hard drives are permanent until altered storage devices inside the computer, but are not called memory.
- \* Floppy disks are portable, permanent until altered, storage devices.
- \* User data files are what you make with application programs.
- \* Application programs are software that you learn to operate to become a computer user.
- \* The operating system is software that runs the hardware.
- \* The hardware is what you're afraid of, but it is as dumb as an anvil.



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